AEROSPACE MUSEUM OF CALIFORNIA

TECHNICAL HISTORY SERIES

AIRCRAFT

The Mikoyan-Gurevich MiG-17
(NATO code name: "Fresco")

(Volume VIII)

A BRIEF HISTORY OF THE MIKOYAN-GUREVICH MiG-17 (NATO code: "FRESCO")

The Aerospace Museum of California is fortunate to have within its excellent air park collection of aircraft, a specimen of the Russian Mikoyan-Gurevich MiG-17PF. This specific example of the all-weather radar equipped version of the MiG-17 (NATO code name: "Fresco E") aircraft was obtained by the US Air Force in the early 1980s from unidentified sources that remain classified today. It is likely that the aircraft was delivered to the United States for inspection by one of the Southwest Asian nations with whom the US maintained ties. At any rate, after the aircraft was completely assessed and evaluated by aviation intelligence specialists, it was consigned to the US Air Force Museum at Wright-Patterson AFB, Dayton, Ohio. In the late 1980s it was reassigned to the McClellan AFB Museum (the museum has since been renamed 'The Aerospace Museum of California'). Today it joins our MiG-21 aircraft as one of the two examples of important former Russian operated aircraft types in our museum inventory.

To appreciate the full significance of the MiG-17 as an expression of early Russian jet aircraft development, one needs to first understand some of the important World War II and post war aviation history that inspired the Mikoyan-Gurevich Design Bureau to produce it and its immediate predecessor, the renowned MiG-15.

BACKGROUND: The German Ta-183 Connection

The decades of the1940s and 1950s were substantially influenced by one of the major wars of the 20th Century: World War Two. Military science and technology had of cessity grown logarithmically throughout World War Two, on both sides of that conflict. In particular, as the war progressed, Nazi Germany had been forced to rely increasingly upon advanced aeronautical research and experimental weapons projects to help offset the numerical superiority of the encroaching Allied Powers. Under the aegis of the RLM (German Air Ministry), a great number of radically advanced aircraft designs were proposed by German aircraft firms, most of which were never actually produced and flown due to the sudden ending of the war in 1945. Even before the war ended, it had become clear to German aeronautical designers that only rocket and jet-turbine engines could provide the speed and performance increases sought in aviation designs of the future. In fact, with only a few exceptions, the advanced German research and development projects remained experimental, but chief among them were a handful of studies that would go on to have profound influence on Western aircraft developments of succeeding decades.

When the European war concluded with Germany's collapse, both the Western Allies and the Soviet Union quickly sent teams of aeronautical experts into the Nazi homeland to retrieve classified documentation, secret data, experimental research, and prototypes (if available) of the RLM's advanced aircraft projects. In the West, the information secured by these teams was distributed to British and American aircraft companies (most notably Convair, Douglas, North American Aviation, Lockheed, et al). The Soviets did the same with their captured Nazi secrets.

In the United States, most individuals who lived through the 1950s period in which early ‘jet age’ experimental aircraft programs were conducted (at Edwards Air Force Base in the Mojave desert) still do not realize that almost all of the exotic American aircraft studied during this period were directly inspired or influenced by that same captured German aeronautical data previously referenced. Convair’s unique multi-Mach delta-winged fighters and bombers, for example, were the products of advanced study carried out by Dr. Alexander Lippisch and the Horten Brothers. So were a number of Douglas Aircraft’s designs (the A-4 Skyhawk is a notable example). The Bell X-5 itself was literally built out of the Messerschmitt P1101 experimental prototype for a variable-sweep wing, high-performance jet fighter (1944), that had been brought to the US after the war ended. Even late 50s and 60s American designs such as the North American X-15 rocket research aircraft and the X-20 *Dynasoar* vehicle were heavily influenced by the theories of Germany’s Dr. Eugen Sanger, who had proposed and designed a ramjet powered hypersonic orbital bomber as early as the mid-1930s.

Thus, when Soviet scientific intelligence gathering teams found a complete set of plans for a radical new swept wing, jet-powered aircraft (the Focke-Wulf Ta-183 jet fighter) at the RLM offices in 1945, work shortly began in Russia on what would ultimately become known to the West as the Mikoyan-Gurevich MiG-15. It was this startlingly advanced early Russian jet aircraft that the museum’s MiG-17 aircraft is directly descended from.

RUSSIA’S DEVELOPMENT OF THE MiG-15

The story of the Russian MiG-15 therefore actually begins in Germany in 1942, when Focke-Wulf aeronautical engineer Hans Multhopp and his team proposed a new jet-turbine powered fighter (designated the Ta-183 *‘Huckebein’*)as a successor to the first German production jet fighter, the Messerschmitt Me-262. In early 1945 an emergency competition was initiated by the German Air Force to develop an advanced, jet-turbine powered fighter aircraft with which to attack ever growing Allied bomber formations. Of the designs submitted, one in particular, an advanced refinement of Multhopp’s Focke-Wulf 1942 Ta-183 proposal, was chosen to be put into production. Rapid progress was made with this plan, despite the harsh wartime conditions, and the first flying prototype example of the Ta-183 was scheduled to have been flown in October of 1945. Unfortunately for the Germans (and perhaps fortunately for the Allies), the war ended and the Ta-183 swept-wing fighter died, unflown, on the drawing board.

When the complete plans for the Ta-183 at the RLM were recovered by the Soviet Union in 1945, they were given to the Mikoyan-Gurevich (MiG) aircraft company for study. Prior to this time, MiG had produced a brief series of conventional straight-winged, propeller-driven fighters (MiG-1, MiG-3 and related models), and had also produced what amounted to a jet-turbine driven version of the MiG-3 (designated the MiG-9) using axial jet-turbine copies of the German BMW 003. The MiG-9 used two of these Russian BMW 003 engine clones, but due to the imperfect nature of their design and their relatively low thrust, the MiG-9 was spectacularly unremarkable and was quickly obsolesced by newer developments.

With the Ta-183 plans in hand, Mikoyan-Gurevich set about using Multhopp’s Ta-183 data to prepare an entirely new and technically advanced jet fighter that incorporated swept wings, designated the “V-310” jet fighter. [This aircraft would soon emerge during the Korean War conflict as the Russian MiG-15 fighter—an aircraft that was significantly better and more capable than the early versions of US jet aircraft initially used in Korea (the straight-winged Republic F-84 *Thunderjet* and Lockheed P-80 *Shooting Star*), but much work remained to be done to improve upon it, first.]

MiG initially built several congruent clones of the Ta-183 design for flight study, based upon the plans found in Germany, and quickly uncovered a number of areas in which aerodynamic improvements were required to make the design truly flyable. Among these was the fact that due to certain low-speed stalling tendencies (a characteristic of the swept-wing), the Ta-183’s forty degree swept wing needed augmented lift devices (such as leading edge slots or wing fences) to counteract this potentially hazardous aspect of the wing sweep. Further, research into other German designs using a “T-tail” horizontal stabiliser (such as found on variations of the Messerschmitt P1101) set high up on the vertical tail assembly, indicated that the inherent high-angle/high speed stall tendency of the T-tail design made it less suitable than a mid-tail horizontal stabiliser; hence the design continued to evolve as MiG pursued research findings derived from its Ta-183 based flying prototypes.

Further, the poor Soviet copies of captured German axial flow engines were clearly unsuited to provide the higher thrust that the design needed. At this time and despite the emerging ideological conflict that was developing between West and East, the Soviets managed to negotiate licensing rights to the more refined British radial-flow ‘Nene’ turbojet engine. Using this far more adequate powerplant, the Soviets were ready to combine the ‘relatively reliable’ design of the British radial turbojet engine with the improved and evolved Ta-183 aircraft. Research progressed quickly and in late 1947 (ironically, at roughly the time the US National Defense Act Air Force created a fully independent US Air Force), the V-310 (MiG-15 prototype) took to the air for the first time. A few months after this first flight of the “improved” Russian version of the Ta-183 ‘Huckebein’, the type was given the service designation of “MiG-15”. A second prototype of the MiG-15 flew in May of 1948 and a third in July of 48, with the first production MiG-15 flying on the last day of December, 1948.

The Russian MiG used a thirty-five degree swept wing (compared to the Ta-183’s forty degree sweep) and the first production prototype incorporated a number of modifications that improved its performance and reliability even further (including a new fuel feed system that helped correct a problem with high altitude flameouts that was common to early turbojet engines). It was indeed a remarkable, quite-advanced jet aircraft, despite a few characteristics that were still problematic. Using a Russian copy of the British Nene jet turbine engine (the Klimov RD-45F) rated at about 5,000 pounds of thrust, flight testing continued. Due to an initial difficulty in producing perfectly symmetrical aluminum airframes, the early MiG-15 had a tendency to roll to one side or the other; this roll characteristic, unique to each individual airframe, was correctable through use of ground-adjustable trim-tabs. The Russian V-310 prototype, while still using the Ta-183’s mid-fuselage wing attachment, featured conventional tricycle landing gear—the main gear folding inwards into the lower wing roots.

The explosively ejected pilot seat used in the early MiG-15 was virtually the same as that used in the earlier (and already obsolete) MiG-9uti (two-seat) straight-wing, twin-jet design. This first MiG-15 egress seat would become standardized as the KK-1 seat (followed later by a similar, but heavily armored seat with deployable aerodynamic stabilization devices known as the SM-2 seat). Interestingly, a direct comparison of the Russian KK-1 seat and the American Republic F-84G seat (both generally known as the first Russian and American production aircraft ejection seats) reveals the fact that both egress schools had their origins in the cartridge-catapult seat system used in the German Heinkel He-162 ‘Volksjaeger’ jet fighter. [In actual fact, the later SM-2 seat is more contemporaneous with the second Republic seat used in the F-84G, while the MiG’s early KK-1 system corresponds more closely to the very first Republic F-84B Thunderjet seat, the original manual seat used in the early production Thunderjet.]. A drawback of the early KK-1 seat (also the case with the American Thunderjet seat) was its right-side only ejection actuation handle. This was changed at a later date to allow either left or right side ejection actuation, but it was at first a potentially dangerous design oversight in the event the pilot lost use of his right arm due to injury.

First encountered in dogfights by the West during the Korean War, the fast, highly maneuverable, and cannon-armed MiG-15 was a shock for American fighter pilots who were then flying the straight-winged Republic F-84G and Lockheed F-80C Shooting Star fighters (both early first generation American jets). However, it is noteworthy that former Focke-Wulf aerodynamicist (and designer of the Ta-183 aircraft) Hans Multhopp had gone to the USA upon war’s end, and thanks to his brilliant researches on the Ta-183 and the high-speed benefits of its swept wing, North American Aviation incorporated his swept wing feature on the straight-wing aircraft they were then producing for the US Navy (the FJ-1 Fury). Thus the famous NAA F-86A Sabrejet came into being, just in time to counter the Soviet Mig-15 threat in Korea.

Again, it should be emphasized that both of these startlingly new, early jet turbine powered fighters owe their existence to Focke-Wulf’s Hans Multhopp developed Ta-183 design. Although the MiG-15 had an edge in climb rate and high-altitude performance, the Sabre had better overall maneuverability and low-speed performance. At about 80% of the weight of a Sabre, the MiG was lighter and carried slow firing, but powerful cannon, instead of multiple, high rate machine guns of lower caliber (like the Sabre), but it is hard to overlook the fact that both of these Korean War antagonists were the direct and indisputable result of the same German pioneering jet research carried out during the Second World War. Moreover, despite a few dissimilarities, both aircraft were remarkably comparable in terms of capability. Two advantages that the F-86 had over the MiG were 1) that its pilots had much better and more thorough training than their Korean adversaries, and 2) a moveable plane horizontal stabiliser. In this last specific, the MiG-15 was designed with a fixed mid-tail horizontal stabiliser that used conventional control surfaces, whereas the F-86 benefited substantially from the enhanced control enabled by the ‘all-moving’ horizontal tail concept. Other differences, such as an advanced radar gunsight also provided benefits over the MiG's simple gun sighting system. However, such was American interest in the Russian MiG that the US offered a substantial cash 'bounty' to encourage a MiG pilot to deliver his MiG-15 to the West; in 1953, this happened, thus enabling the US to finally and fully evaluate the capabilities of its formidable Russian antagonist at first hand.

THE MiG-17 DEVELOPMENT

In continuing development of their first swept-wing jet, Mikoyan-Gurevich improved on the MiG's design continuously from the onset. Of no little importance in this work was intelligence coming to Russia from the West on the North American F-86 development. Incorporating a fuselage that was three feet longer than that of the MiG-15, a new *MiG-15bis I-330* fighter design was introduced. Shortly thereafter designated the production designation of *MiG-17*, the improved aircraft featured a number of refinements that included a sweep of forty-five degrees (instead of thirty-five), a new, thinner wing-section (for improved speed), and enlarged air-brake panels. Also incorporated was an up-rated engine (the Klimov VK-1F, rated at about 7,450 pounds of thrust with afterburner) that increased maximum speed to about 711 mph (Mach 0.98). First flight of the MiG-17 occurred in January of 1950. Nominal ceiling of the new aircraft was about 57,000 feet. Production of the MiG-17 began in late 1951, and the first operational MiG-17s appeared in 1952. There were not enough of them to be introduced during the Korean conflict, but 5 subsequent models of the MiG-17 design saw extensive service in the Vietnam War of 1965-1975. Weighing about 13,400 pounds (maximum take-off weight), and armed with two 23 mm cannons and one 37 mm cannon, the MiG-17 packed a formidable punch in its air-to-air combat role.

During the early days of the Vietnam War, Mig-17 fighters frequently tangled with American jets and due to its high maneuverability and light weight, the tight-turning MiG-17 was often a difficult target to hit. American F-4C Phantom IIs and Republic F-105 Thunderchiefs, although substantially faster (and heavier), could not successfully engage the small and dangerous MiG-17 in close dogfights safely. Thus the only sure way to kill a MiG was through use of air-to-air missiles at a safe distance; fortunately, most American fighters had sophisticated search and targeting radars and a range of AIM type missiles to employ in this role. [The MiG-17 could also carry two Atoll AIMs on wing-pylon stations; these were IR/heat-seekers almost identical in design and function to the US-made 'Sidewinder' missile of the period.]

Early MiG-17s used the KK-1 ejection seat, although most later versions used the heavily armored SM-2 ejection seat, with its 25 pound headrest armor plate and 35 pound armored back plate that could stop a 20 mm cannon shell. Whereas the KK-1 seat used bilateral armrest ejection actuation handles, the SM-2 seat featured a primary face-blind actuation system (similar to that used on all UK Martin-Baker seats through the Mk.7 series); bilateral secondary armrest ejection handles were provided, however. Interestingly, the Russian ejection seats were quite effective in emergency use and somewhat more successful than American developed counterparts up until the advent of the American ACES II system in the early 70s. Already good, Russian ejection seats continued to improve, to the point where they today compare favorably with the best aircrew egress systems built by any nation.

As with most contemporary fighters from all nations, the MiG-17 had a pressurised cockpit and was typically ‘over-built’ in the conventional ‘sturdy’ Russian manner. With heavy duty landing gear designed to be used on rough or poorly prepared landing strips and solid, rugged aluminum construction throughout, the MiG-17 could be rather easily maintained in the field by ground crews. Most maintenance problems could be fixed with simple equipment and ordinary tools. In addition to the original day-fighter version, an all-weather version of the MiG-17, equipped with the RP-1 ‘IZUMRUD’ radar system and designated the MiG-17P was soon produced. A further all-weather interceptor version with upgraded radar was designated the MiG-17SP2 was produced; this is similar to the ‘PF’ version that the Aerospace Museum of California has in its collection, but had its radome situated forward of the intake splitter at mid-center. Various other variants of the MiG-17 (with improved radar, sights, and weapons systems) were produced over the years and the aircraft was additionally license-built by a number of other nations (at least 25), numbering eventually in the thousands. [The MiG-17 SP-2 version had roughly similar capabilities to the US F-86D *‘Sabre-Dog’* interceptor.]

The Chinese produced version of the Russian MiG-17 was designated the Chenyang J-5, and upgraded versions of the J-5 are still in use in China today, despite increasing obsolescence. It is worth noting that it was the threat of the MiG-17s formidable cannons that reversed the US Air Force’s philosophy of forsaking guns for air-to-air missiles in the late 50s and early 60s. Since that time, all subsequent US fighters have been equipped with a standard 20 mm gatling-gun type weapon, in addition to their range of sophisticated AIMs (AIM = Aerial Intercept Missile).

A final development of the MiG-15/17 concept was the MiG-19 (NATO code name = ‘*Farmer*’), which was the first Russian *mass-produced supersonic* jet fighter. It is safe to conclude that the basic MiG-15/17/19 series of aircraft that all developed from the original German Focke-Wulf Ta-183 design studies of the 30s and 40s have been among the most interesting and successful of early post-war jet aircraft designs in the world. We of the Aerospace Museum of California consider ourselves fortunate to have a specimen of this fascinating type in our aircraft collection, although as mentioned earlier, the circumstances by which it originally arrived in the US are still cloaked in conjecture (and remain classified).

Today, there are several MiGs in the USA that are privately owned and flown. One of these is the ‘Red Bull’ MiG-17, owned and flown by Bill Reesman at airshows across the nation. Seeing this agile and nimble ex-military fighter perform aerial displays at airshows is always a thrill, and according to Bill (and others who have flown the MiG-17), the MiG-17 is itself a joy to fly, with very few if any of the inherently unforgiving flight characteristics possessed by the original MiG-15 design (it took a skillful pilot to exploit the MiG-15’s full potential safely, as there were a few nasty little surprises awaiting the unskilled at the edges of the MiG-15’s performance envelope).

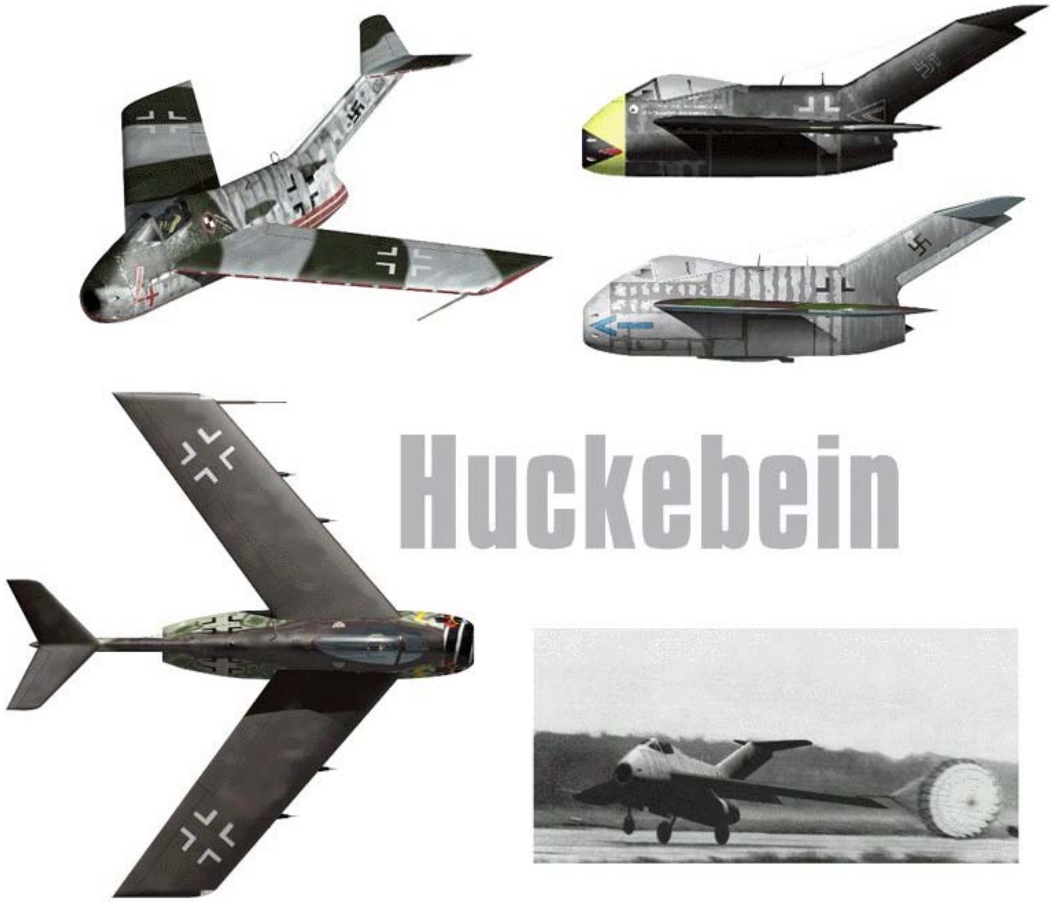
POSTSCRIPT

As noted earlier, it was German Focke-Wulf company aeronautical engineer Hans Multhopp who, under Director Kurt Tank's direction, originally developed the Ta-183 jet fighter design back in the early 40s. When WWII ended, Multhopp relocated to the US, where his knowledge of wing-sweep characteristics prompted use of wing-sweep on both the North American F-86A *Sabrejet* and the Republic F-84F model *Thunderjet*. Whereas the Ta-183 had a metal fuselage and wooden wings, the American and Russian developments based upon it were of all-aluminum design. One final note: Focke-Wulf design department director Kurt Tank immigrated to Argentina in 1947, where in collaboration with the Argentinean government, he attempted to develop the Ta-183 design into a workable jet fighter designated the I.Ae 33 *'Pulqui II'*. For reasons unknown (theTa-183 was, after all, Hans Multhopp's design, not Tank's), Tank relocated the wing position of his Pulqui II design to the upper fuselage, a configuration that resulted in severe stall problems at high angles of attack. The aircraft known as the *Pulqui II* first flew on 27 Jun 1950 and landed successfully without incident, although it exhibited a disturbing tendency to pitch-up suddenly without warning and was reportedly somewhat unstable. Although the stall problems associated with the relocated wing position appeared to be resolvable with further work, when the regime of Juan Peron ended in the early 50s, one immediate consequence was that Tank's work on the Pulqui II could no longer be funded. Thus the Argentinean Ta-183 proposal came to a permanent end in 1954-55, after only 6 examples of the Argentinean Pulqui II had been built.

MIG 17PF "FRESCO E" SPECIFICATIONS:

Crew: One.
Power: One Klimov VK-1 radial flow turbojet, 5,955 lbs thrust (7,450 lbs with afterburner)
Span: 31 ft 7 in.
Length: 40 ft.
Height: 11 ft.
Weight (empty): 8,665 lbs
Maximum take-off weight: 13,389 lbs.
Rate of climb: 12,795 feet per minute
Speed: 710 mph (Mach 0.975) at 10,000 ft.
Ceiling: 57,000 ft.
Range: 510 miles (internal fuel only, increased to 1200 miles with wing tanks)
Armament: Three cannons in nose (3x23 mm); provision for two packs of 8 x 55mm air-to-air rockets on pylons, two Atoll air-to-air missiles, or 1100 lbs of bombs.

below: The German Ta-183 *‘Huckebein’* design that inspired the MiG-15 (artist unknown)



Below: The straight-winged MiG-9, first Russian jet design (image: MiG Okb)

Above and below: Ta-183 'Huckebein' as illustrated by artist Marek Rys.

Folke-Wulf Ta-183 as illustrated by artist Gareth Hector

Russian MiG-15 (photographer unknown); note wing fences and cannons under nose.

Above: MiG-15 side view (image: ‘Gunpoint Images’); note fixed mid-vertical fin horizontal stabiliser

Above: MiG-15 seen from rear aspect (image: 'Gunpoint images')

Above: "Red Bull" MiG-17 at air show (photographer: Michael Carlyle)

Above: Chenyang J-5 uti (Chinese MiG-17) in flight (photographer Gerhard Plomitzer)

Above: Czech MiG-17 on ground (photographer unknown)

Above: Mig-17 on ramp (photographer Luis Rosa)

Above: Chinese Chenyang J-5 license variant of Russian MiG-17 (photographer unknown)

The Aerospace Museum of California's specimen of the MiG-17PF ('Fresco-E')

US Air Force Museum's Chenyang J-5 (Chinese version of MiG-17)

The Swedish J-29 'Tunnan' ("Tuna"), another early jet inspired by both the Focke-Wulf Ta-183 design (and also by the Messerschmitt Me-P1101 project).